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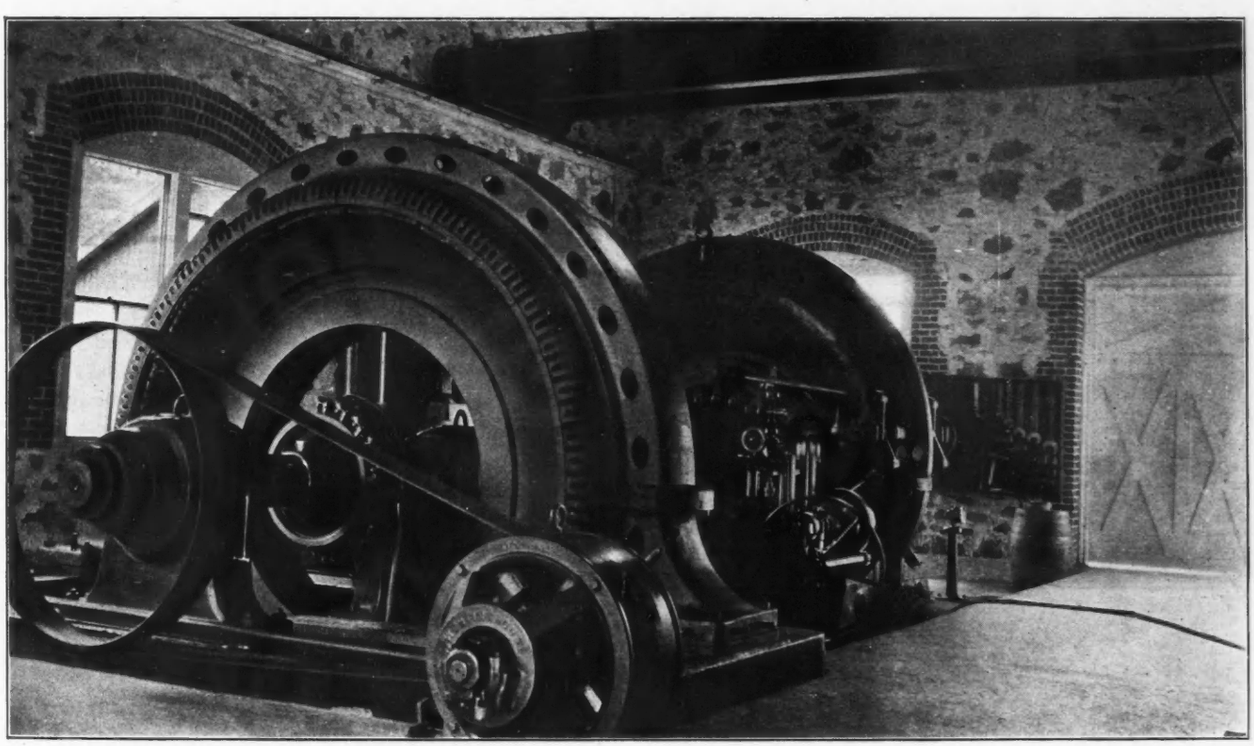
The Transmission System of the Truckee River General Electric Company

By B. C. Condit.

During the year 1905 the Truckee River General Electric Company extended its transmission systems in Nevada by the addition of a complete new power plant on the Truckee river, between Floriston and Verdi, constructed a new pole line to Virginia City and built a new sub-station, with complete and enlarged equipment, in Virginia City.

There are five more sub-stations for both lighting and power distribution, and in addition several sub-stations for separate mines. The transmission lines total twenty-five miles in length, not including the numerous secondary distribution circuits.

The older plants of the Truckee River General Electric Company have been fully described in the "Journal," and this



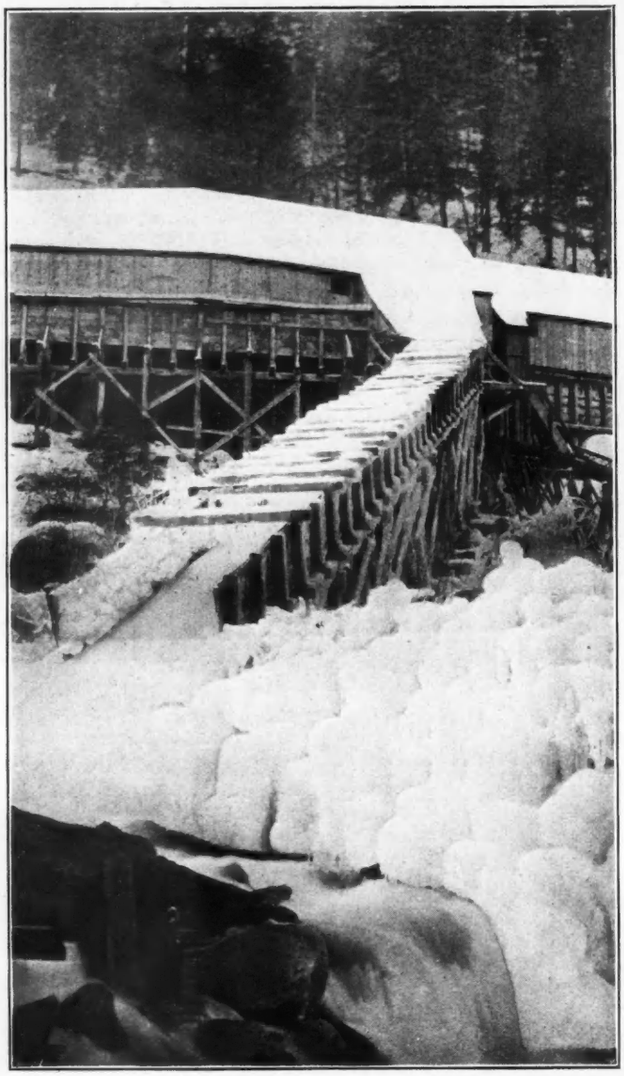
TWO-THOUSAND-UNIT IN FLEISH POWER PLANT.

The original plant, now known as the Forad station, is located at Floriston, and was completed in 1900. About two years ago the company acquired the Waso Power Company's plant on the Truckee river, about seven miles west of Reno, all of these plants are now being operated together. The system, as it now stands, consists of four separate water power plants, having a combined capacity of 5,400 kilowatts.

article is intended to make the description complete for the entire system, and is devoted to the extension completed during the last summer.

The new power station is known as the Fleish plant, and is located on the Truckee river, about three miles west of Verdi. The water is diverted from the river by a rock filled crib dam, 200 feet long and 24 feet wide, which raises the

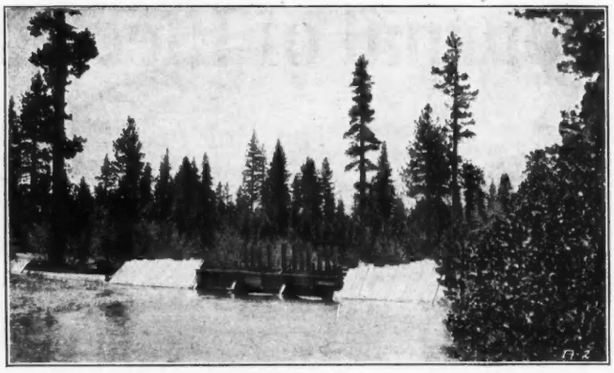
water from its lowest stage about 5 feet. The dam is constructed of 12x12 inch pine timbers fastened together with ⅞ inch iron drift bolts. The up and down stream slopes of the dam are both one to one. The crest is 10 feet wide and an apron is provided on the down stream side to prevent undercutting during the periods of high water. The entire dam is planked with double 2-inch pine, and at each end terminates in a bulkhead 24 feet by 16 feet, these bulkheads being 6 feet higher than the crest of the dam. At right angles to the dam



VIEW OF SPILLWAY AT FARAD POWER HOUSE COVERED WITH ICE.

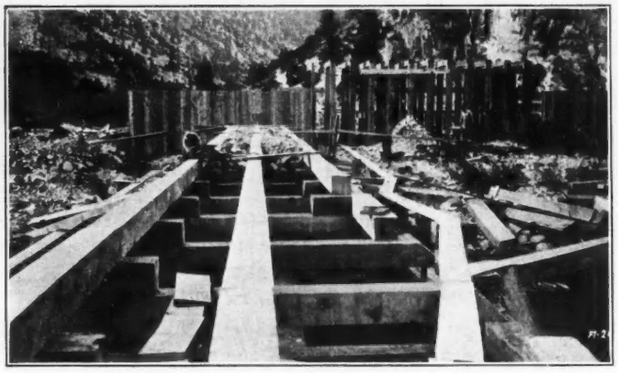
are the diversion head gates, twelve in number, each 2 feet 6 inches by 4 feet 6 inches in size, and controlled by a rack and pinion with lever. The small size of the gates and the low head gives easy operation.

The gates discharge water through a short section of the flume into a natural water way, where a small amount of excavation formed a reservoir about 1000 feet long. At the lowest end of this reservoir is the beginning of the flume, at which point an end overflow with flash boards is provided in case they are required during sudden floods.



DAM ON TRUCKEE RIVER AT LAKE TAHOE.

The flume is built on a bench graded in the hill side, wherever possible. The trestles, where required, are constructed very solidly with bents 8 feet between centers and with four 10x10 inch posts and 10x10 inch caps. Four stringers, each 8x14 inches, are laid on the bents, the joints being broken to provide additional strength. The sills and

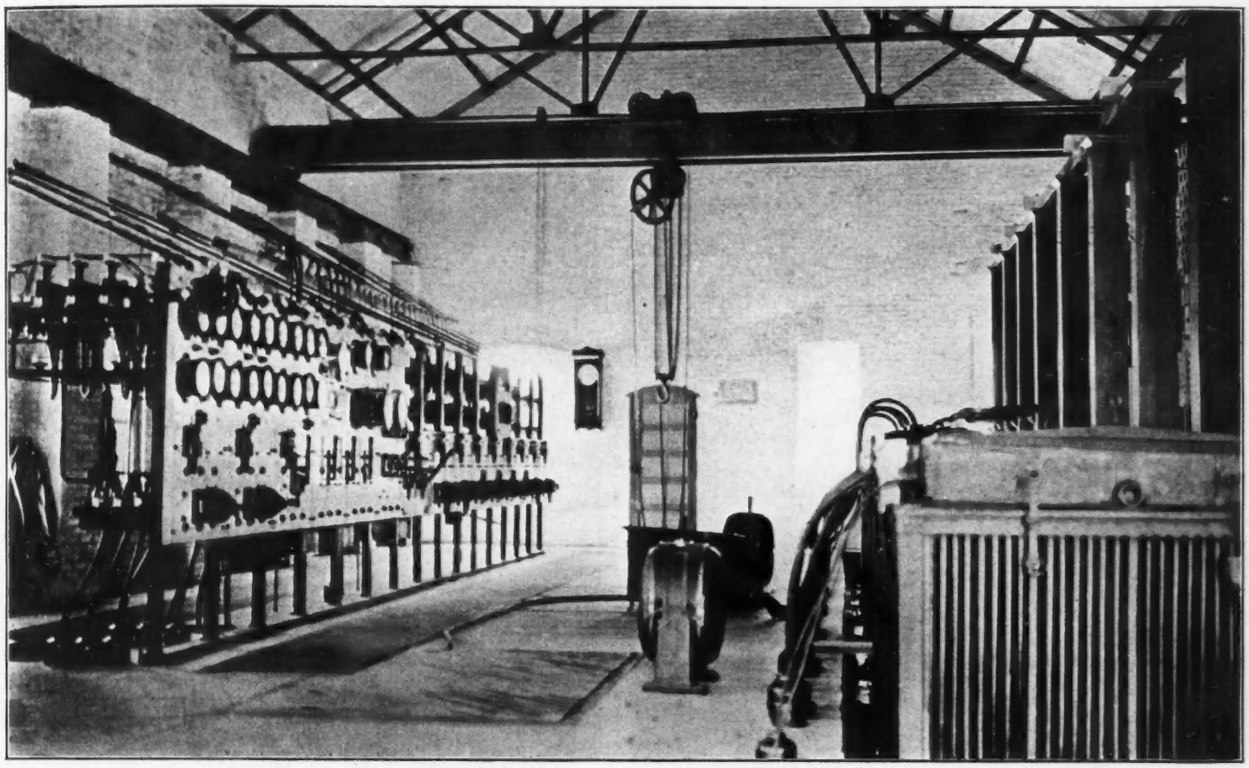


DAM AND HEADGATES AT FLEISH POWER HOUSE DURING CONSTRUCTION.

side posts are 6x8 inches with 6x6 inch caps. Yokes paced 2 feet 8 inches between centers are also included in the flume construction.

The flume box, 10 feet wide and 6 feet 6 inches deep, is constructed entirely of surfaced Oregon pine, grooved on both edges and laid with a separate tongue in the grooves,

BREAK IN FARAD POWER PLANT FLUME CAUSED BY CLOUDBURST, AUGUST, 1906.

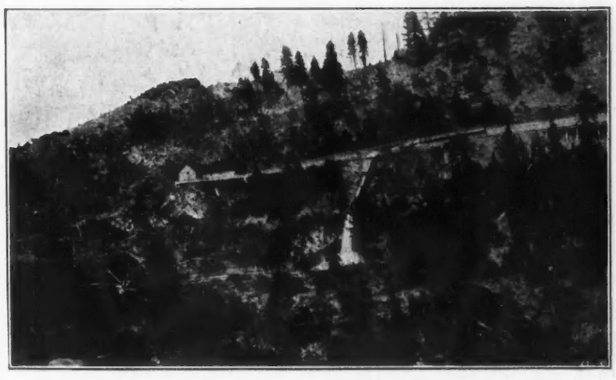


INTERIOR OF VIRGINIA CITY SUB-STATION.

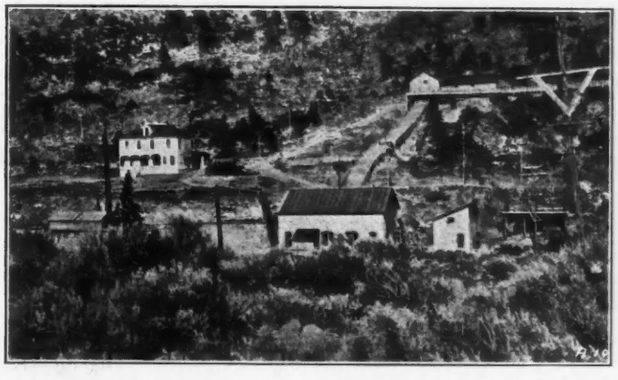
making the joints water tight. This construction has proved very satisfactory, is cheaper than battens, and makes a much tighter flume. Also for a given size provides a greater carrying capacity. This flume was designed to carry 250 cubic feet per second, with the water 5 feet 10 inches deep. Careful tests made, however, show that the capacity at this depth is 285 cubic feet per second.

In the entire water conduit way is only one length of ditch. This is 12 feet wide on the bottom, and has banks sloping one to one, the grade of the ditch is the same as the flume, 6 feet in 1000 feet. The ditch is of ample carrying capacity, and was so designed and constructed that rocks and small earth slides which might go into the ditch would not diminish the carrying capacity of the flume, thereby avoiding cleaning the ditch, except at long intervals. The complete water conduit system is 12,000 feet in length.

The penstock at the lower end of the flume is provided with a screen made of flat iron bars, spaced 1 inch between centers, the total area of the screen being 600 square feet. It is divided into sections, each section being hinged so that any section may be raised for cleaning or may be completely removed. The entire penstock is housed, this construction having been found necessary from experience in the other plants of the company. Six gates, each 4x6 feet 6 inches, located in



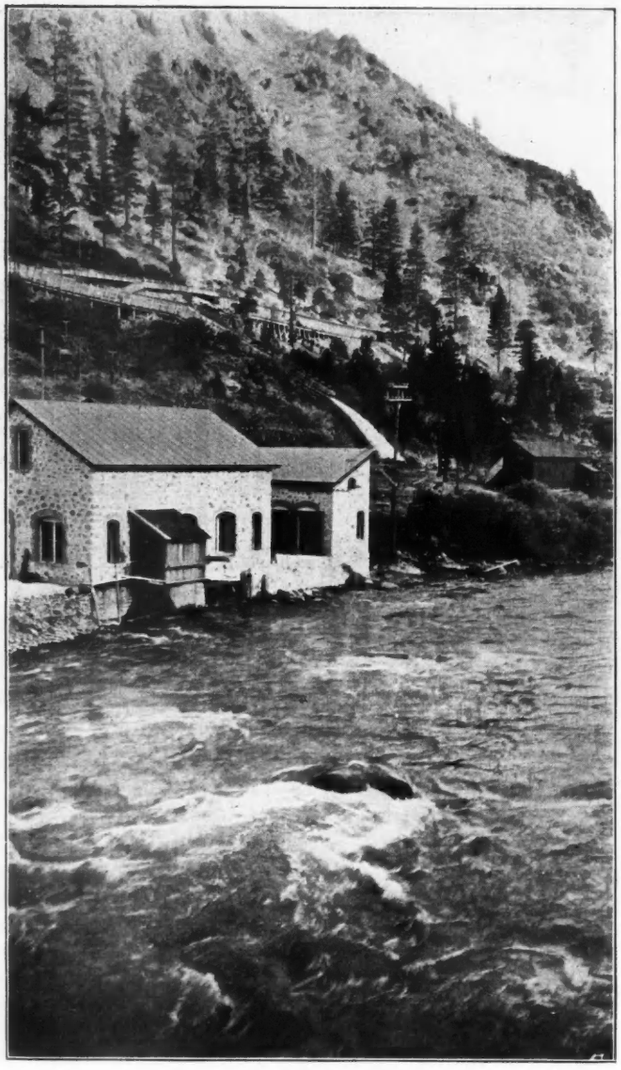
FLUME, PENSTOCK AND SPILLWAY AT FLEISH POWER HOUSE.



FLUME, PENSTOCK, AND COVERED PIPE-LINE, AT FLEISH POWER HOUSE.

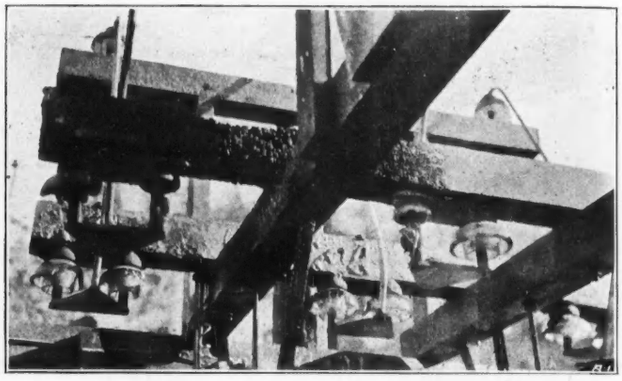
the penstock, control the water of the pipe line. These gates, with one exception, have the same equipment for operating as the gates at the intake. This gate is equipped with gears, which makes it possible to operate it more readily than the regular gates.

From the penstock a single steel pipe line 8 feet in diameter, leads to the power station, giving a static head of 125 feet.



FLEISH POWER HOUSE.

At the present time there is installed in the power station one 3,000-horse power Victor spiral flume turbine and a 2,000 kilowatt 3-phase, 2,200 volt Westinghouse revolving field generator, the side of the unit being a type N, Lombard governor. Two 14 inch Lombard relief valves are mounted on the wheel case. The exciter is belted to the generator and is equipped with a Tirril regulator. The preliminary tests indicate that the efficiency of the turbines, at normal load, exceeds 80 per cent, and during the test the plant was made to deliver to the switch boards 2,370 kilowatts. The unit has given excellent results, particularly as regards the efficiency of operation and voltage regulation.



..A BURNED-UP 23,000-VOLT SWITCH AT FLEISH.. POWER HOUSE.

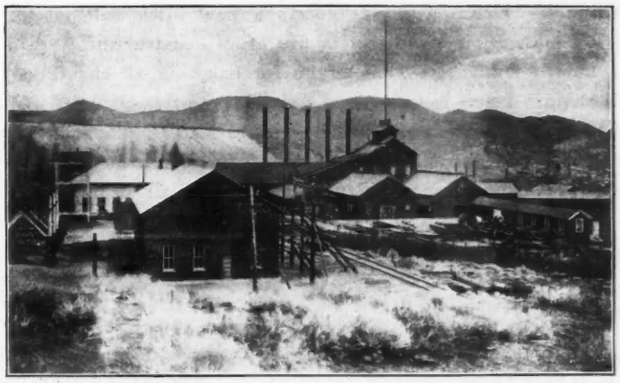
There are four 750 kilowatt Westinghouse step-up transformers installed in the transformer house, separate from the main generating station, one of the transformers being a spare. Each transformer is mounted on an iron truck on a track, which runs into the main power house, where a twenty ton crane is installed. The transformers are water and oil cooled, and the water is controlled from the main generating station, where the discharge water from the transformers is also delivered, so that the entire system of water cooling is at all times under the eye of the attendant in the generating

OVERFLOW AT FLEISH SPILLWAY.

WHAT A LAND SLIDE DID TO THE FLUME OF THE FLEISH POWER PLANT IN JANUARY, 1906.

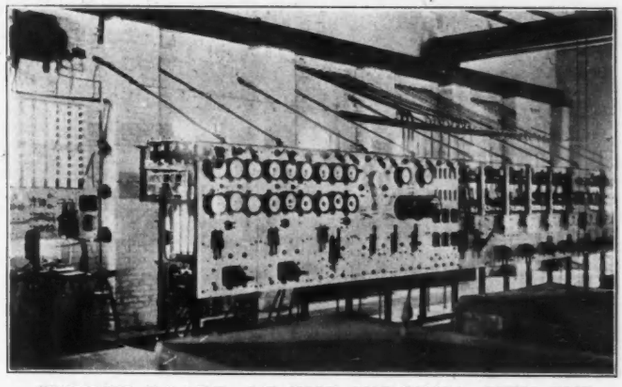
SPAN 1,105 FEET LONG IN TRANSMISSION LINE.

station. Each of the transformers are supported on eye-beams, over a sloping trench, which trench will deliver the oil directly to the river in case of fire. In the transformer house, separated from the transformers by a fire wall, are three Westinghouse, low equivalent lightning arresters with



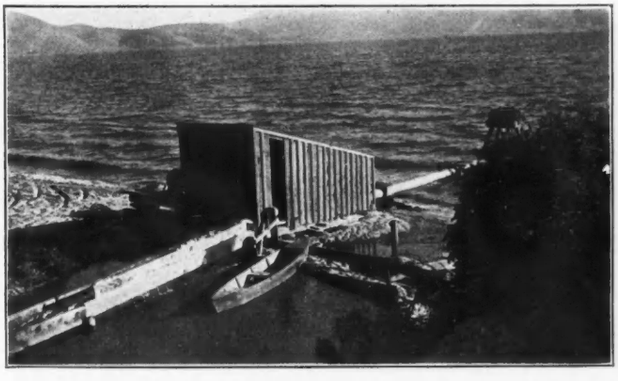
VIRGINIA CITY SUB-STATION AND C AND C SHAFT.

choke coils. This arrangement of transformers and stone construction of building reduces the fire hazard of the plant to a minimum. Out side the power house is a group of nine air break, high tension switches, which permit any combination to be made between the transmission station and the three generating stations.

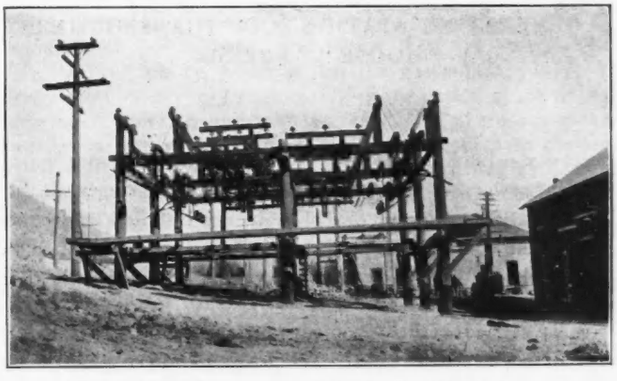


SWITCH BOARD OF THE VIRGINIA CITY SUB-STATION.

The transmission line to Virginia City consists of 35 and 40 foot cedar poles, spaced 200 feet apart for the regular construction, and as much as 1,000 feet apart where canyons are crossed. Three No. 1 B. & S. aluminum wires provide the 3-phase circuit and Locke 7 inch glass insulators are used, the cross arms being such that the insulators are located at the corners of a 6 foot equilateral triangle.

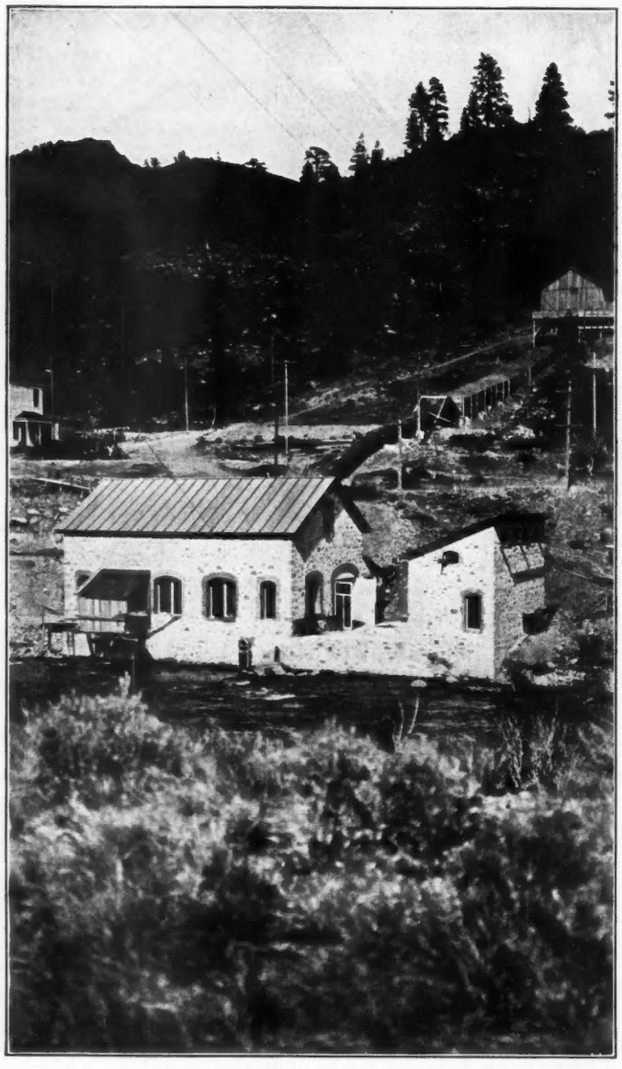


ONE OF THE DOUGLAS PUMPING STATIONS AT WASHOE LAKE.



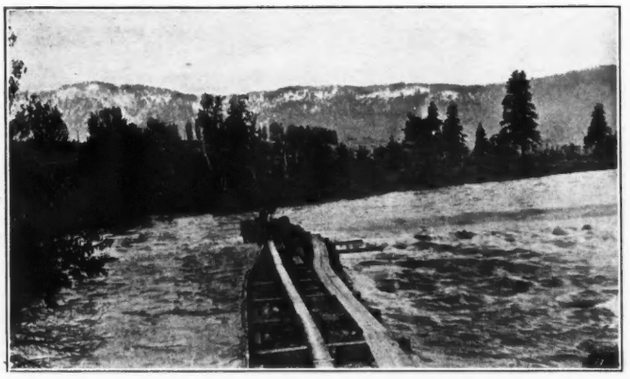
HIGH TENSION 23,000-VOLT SWITCHES AT VIRGINIA CITY SUB-STATION.

At Virginia City another group of switches is installed, through which the circuit enters a new brick sub-station. This sub-station is entirely of fire proof construction, and is equipped with a traveling crane for handling all the transformers. There is one set of 625 kilowatt transformers and one spare transformer of this size and also two sets of 250 kilowatt transformers. These transformers are all installed over a concrete trench, arranged to carry off all oil in case of



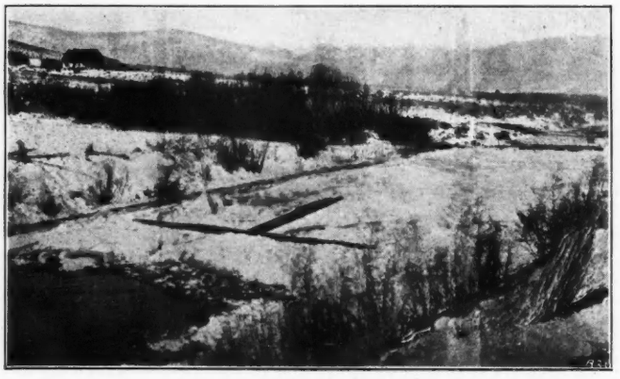
GENERATING STATION AND TRANSFORMER HOUSE AT FLEISH.

necessity. Each transformer is also connected with independent sewers, so that it is possible to quickly empty all the oil from the transformers. Oil tanks are installed below the level of the floor, each side of the building, it being possible to deliver the oil to these tanks and refill the transformers by applying compressed air to the tanks. All the high tension wire is carried in fire proofed wooden boxes as safeguard against accidental contact. The transmission voltage is at 23,000 volts, and line has both star connected and delta connected transformer sets working in parallel. Secondary leads



HIGH WATER AT DAM OF WASHOE POWER HOUSE.

are carried to a group of single pole knife switches so that the spare transformer may be cut in or out of the circuit with the least possible delay.



AN ICE JAM ON THE WASHOE DITCH.

The main switch board in the sub-station is equipped with the usual switch board instruments and appliances. All distribution circuits are controlled with automatic switches, with time limit over-load relays and without fuses. All sub-

WASHOE GENERATING STATION AND TRANSFORMER HOUSE.

stations are equipped with fuses in the entire high tension line, but no fuses are used in the generating station.

This power plant was put in operation in October, 1905, and during the past year has given excellent service.

SOMETHING ABOUT GAS ARC LAMPS.

In the first place, let us consider what a gas arc is worth to a gas company as a revenue producer. Most gas men of to-day will all agree that 24,000 cubic feet per annum is a very conservative estimate for 4-burner arc lights. However, it is the opinion of the writer that 36,000 cubic feet is a modest estimate on the consumption of a 4-burner arc, if sold by a salesman of gas, instead of being placed on the market by a salesman of appliances. The salesman of gas will in all cases endeavor to put the arc lights on the market where they will work the greatest number of hours. On the other hand, the salesman of appliances will endeavor to sell arc lights any place where they can be hung, regardless of what they would burn. The difference between the salesman of gas and the gas apliance salesman is obvious, and the average estimated consumption of arc lights may be greatly increased or lowered according to the salesman and plan you have of placing the arc lights on the market. In order to obtain a first-class salesman, pay him always according to the quality of his business, as well as to the quantity.

To save time, and to avoid an argument as to the average estimated consumption of gas arc lights, let us concede it to be 24,000 cubic feet per annum. Now, compare the gas arcs with the gas range at an averaged estimated consumption of 16,000 cubic feet per annum, which is considered a very liberal estimate by the gas men from Coast to Coast. There, in plain facts and figures, we have the gas arc leading the range by 8,000 cubic feet. Inasmuch as gas companies derive the bulk of their revenue from gas sold for the purpose of lighting and cooking, it simply means the gas companies must depend principally on gas arcs and gas ranges. Any appliance that will consume gas and give the consumer satisfaction has its place in the sales end of the gas business, but after all only incidentally to the chief revenue producers, namely, the gas arc and the gas range. When you sell a consumer one range, that is all he really has use for, and in fact all he needs. It is just the reverse with the gas arc. When you sell a gas arc, if indeed you but sell one, it is only a matter of a very short time when the consumer will discover he really needs from one to several more gas arcs. So to be as brief as possible the writer will say that, as a result of his experience in many different States, the average of three arc lights to a consumer is not at all excessive. Now then, we have three arc lights to a consumer as against one range, or 72,000 cubic feet against 16,000 cubic feet, according to the universally acknowledged averaged estimation of these appliances. Some gas men will say they sell ten ranges to one arc, and if so they would be deserving of great credit for the gas range sales, but the same couldn't be said as to the output of their gas arcs. There is not a city of 75,000 poulation or over, but can make their gas arc light sales equal that of their ranges, and as the cities increase in population so should the sales of gas arc lights increase in proportion to the sales of gas ranges, at least three to one, including residence arcs. Residence gas arcs for residence use should average 10,000 cubic feet per annum, but suppose they only average 5,000 cubic feet per annum, and from one to three could be installed in every residence, would not that be a great increase in the residence district? Every house has room for a gas range, and always has room for one or more residence arc lights. Not so with every house as regards to the gas range, because there are several houses that actually do not have room for a gas range, but in every case have room for a residence arc light. There is a great deal more that could be said in favor of the gas arc as a revenue producer, but let us rest that question with the above remarks and proceed to the next phase of the subject.

Having briefly considered some of the reasons why we should sell the arc lights, the next question is "How shall we sell them?" At the very start off secure the best "salesman of gas" that money will obtain, for it is better to have an expert in this line of work for two months at a high salary than to employ inexperienced men on a small salary for a year. Carefully consider and study the local situation, especially with reference to such competition as there may be, taking great care not to fall into the common error of overestimating the competition. After the above consideration it will be possible to outline a systematic plan to sell gas arc lights that will give a large and certain increase in gas sales. No matter how clear a field there may be regarding competition at present, always remember to regulate the methods of doing business with the plain fact in view that we are on the market to sell and increase the sale of gas as a permanent institution. The public of to-day must be catered to. After an increase in gas sales has been obtained there is no other business in the world that will require any more nursing and cultivating to retain it. Stay right with it all the time. The increase in gas sales will depend largely on the success met with in holding that which has already been obtained. Whenever competition is light enough to place appliances on the market without losing money, it is but fair to do so, providing the margin of profit is not progressively increased, until a bad obstacle is placed in front of the main feature to be accomplished, that of selling gas. There are very few people who would buy a dozen gas arcs at $12 each, as against many people who would buy a dozen at $8 each. The cost of equipment often stands in the way of a very fine piece of gas business when the gas company insists on making quite a margin of profit on appliances. This is not as it should be. Cut out the profit on appliances. Sell them at what they cost you installed, and increase your output of gas sales that much. If it is thought wise to make a profit on appliances, why wouldn't it be better to make that profit on miscellaneous appliances, which ordinarily consume very little gas, and then keep the cost of the gas arc and the gas range as low as possible? It would be out of the question to outline a method of procedure which would be applicable to all conditions, but one interesting case in point will be cited.

A commerical department consisting of fourteen men, located in the State of Ohio, competing with natural gas at 45 cents per $1,000 cubic feet as against 95 cents per 1,000 cubic feet for artificial gas, in a period of 90 days installed 1,400 arc lights, 800 of these being natural gas and electric displacements and the balance increased consumption. To accomplish such a wonderful result arc lights were installed on the following basis: Consumers would sign a contract to pay a minimum charge of $1.50 per month for each arc light installed, this amount to apply on their gas bill. In additional to the above chage the consumer would pay 25 cents per month per arc light for maintenance, and the entire contract would be signed for a period of three years. Simplified, the above plan means the gas company loaned the consumers as many gas arcs as they could use, for a period of three years, and consumed not less than $1.50 worth of gas per arc light every calendar month during the period of the contract. At the end of three years, instead of renewing these contracts, it will be a very easy matter to sell most of these arc lights as second-hand, for $5 each, just where they are hung. The main feature will be, however, for the gas company to give perfect service in every respect during the period of the above mentioned contract, and then at the end of three years the consumers will be glad of an opportunity to purchase the arc lights and burn what they like without being tied to a contract at all. Again, some of the above mentioned arcs were sold on a one-year contract at what they cost the gas company installed, provided the consumer would agree to burn artificial gas for a period of one year. You must form your own conclusions as to whether such methods were wise in the natural gas country, and in summing up the situation, do not overlook the increased revenue made for the gas company by this method of installing arc lights.

Another good plan for installing gas arc lights is that of renting them for $5 per year in advance, including main-

tenance. At the end of the year the consumers can lease the arc for another year at the same figure, or they can purchase and own the arc by paying $5, the gas company crediting $2 of the $5 paid in advance to the maintenance and the balance of $3 for the rental of the arc. If the consumer decides to buy at the end of the first year the company will have received $8 for its arc light according to these figures submitted to you. If, on the other hand, the consumer decides to lease for another year, you have received $6 for the arc light and $4 for the two years' maintenance. This money being paid in advance, at the end of the second year we can afford to sell the arcs for $4 to the consumer, and then will have received $10 for the arc and $4 for two years' maintenance, which gives a total of $14 per arc light, including two years' maintenance. Out of the total of $14 received on the above plan, credit $6 to the maintenance and still you have a balance of $8 to credit to the sale of the arc light. The cost of maintaining arc lights differs considerably for many reasons, a few of which might be considered.

First, the territory may not average two arc lights to a consumer, which will have a tendency to make the maintenance expensive on account of the ground you have to cover. That can be overcome by forcing your gas arcs to make a larger average per consumer.

The best manner in which to make the maintenanc eexpensive is to engage cheap and incompetent help to take care of arc lights. The man in charge of a gas arc maintenance route can very easily make or waste his day's pay by a little carelessness and lack of good judgment. This sort of man would not have to go far before the cost of mantles would cause the maintenance to be a mighty expensive proposition. Why wouldn't it be good policy to pay the maintenance man a fair day's wages, and in addition to that, a suitable bonus for perfect work performed, according to the satisfaction of the consumer? Pay the men the bonus on the first of every quarter. This length of time wouldn't be long enough to cause the man to lose heart in his efforts, and on the other hand would be a good stimulant to retain first-class permanent men, such men in fact as gas companies must engage to perform the duties in one of the most important departments connected with the whole gas industry to-day.

It is only the man that has personally mixed with the consumers who thoroughly understands the great necessity of a perfect working maintenance department. When so much depends upon it, why not study the question constantly, watching every opportunity to better the service and always make it a little more perfect? On the bonus payment plan the maintenance man should be given credit marks for perfect work accomplished with the least material used. In the event of complaints reported the man should have marks deducted from his credit, according to the nature of the complaint received. Likewise the men should receive their ratio of the bonus according to the least material used. Cause considerable bookkeeping? Oh, yes; some. However, a mere bagatelle when you consider the object and the result to be accomplished thereby. Passing now to the next natural division, what shall we say to cause the consumer to buy arc lights? Say almost anything you think the consumers would want you to say, and agree with them in all their troubles. Never approach a man directly with the suggestion to increase his gas bill. That above anything else in the world is repulsive to most prospective consumers. They will increase many other expenses willingly, but when it comes to asking them directly to buy more gas they are ready to annihilate you. Consequently the intelligent gas salesman will endeavor to sell his gas to a certain extent in disguise. For example, he will point out many instances where expenses can be cut, in which a business man is spending his money uselessly and absolutely without returns. Then turn and show him where this money that has been wasted can be applied with results which must be far ahead of the manner in which he has been operating. It will be very necessary to make no mistakes, to understand the proposition thoroughly and to present it in a shrewd, calculating and convincing manner. Alawys be able to prove and stand behind any statements you may make to a consumer. Again, use your very best endeavors to so word your statements that they will be perfectly clear. Never try to sell a man gas by getting him mystified, for invariably when such consumers become perfectly clear on the matter they will say you misrepresented the proposition. Talk illumination for advertising and gas arcs for illumination. There is nothing to beat that argument with the inside and outside gas arcs. There are articles with which a consumer can be served with considerably more of the best kind of advertising for the least money, just when and where they need it, than with anything else on the market. In such advertising they are not compelled to gamble on results, but they can observe to their entire satisfaction great big returns for the investment.

The objection of the heat in gas arcs, as against that of electric lights, can be largely overcome when you show the consumer that he can purchase gas for lighting for so much less than electric lighting, that he can pay for the use of fans during the hot months and still have a good sum of money left to his credit which he would not have if he burned electric lights. The gas company can afford to use liberal consideration toward its chief competitor, the electric company. There is a whole lot of business in the way of lighting and power that the gas company does not want, and is not entitled to. The wise manager of an electric company knows perfectly well where the line is and should confine his company's efforts in soliciting business to that class of work which he is better able to serve the public.

To-day the electric companies are in no position to compete with gas companies in serving light for straight illumination or window lighting.

The famous great white light, more commonly known as the outside gas arc, has made window lighting the greatest, cheapest and best proposition which a merchant can indulge in to-day. They not only light his windows in the best possible manner, but they light the whole front of his store and street at the same time, for the one cost. If the outside arc is such a grand proposition, why don't more of the merchants use that instead of electricity? Simply because the supply of first-class, retail commercial gas salesmen is very limited. Consequently the gas company has not been able to present the subject of outside window lighting as it should be to the merchants in most cities, and have very wisely refrained from sending out inexperienced men who make a miserable failure and only weary the business men.

Great caution must be exercised regarding the kind of men you intrust your business territory to, but most any kind of a house-to-house peddler can make a gas range salesman. It would be indeed an injustice to the outside gas arc for window lighting and novelty advertising to rest the subject without stating something of the virtues as referred to.

In times gone by, it was the aim (and thought to be proper) of merchants to just fill their windows with all the incandescent electric, and in fact every other kind of lights they could possibly find room for inside their windows, with a result that they had such a beautiful display of lights mixed right in with their wares they were advertising, that when the public stopped to inspect their windows they were impressed with the beautiful display of lights and hardly noticed the goods really meant to be advertised. The time arrived when the merchants noticed this effect and proceeded to apply a remedy in the form of partially incasing incandescent lights inside of tin-lined grooves or alleys at the top, side and bottom of the windows, the idea being to hide most of the light and throw the balance on the goods they were advertising. They have to pay for the light they are hiding and wasting as well as the portion they are using, and using to a mighty poor advantage by this method. With the outside gas arcs equipped with an alabaster globe, installed

properly on the outside and in front of the windows, the merchant will receive the following benefits: First, more actual candle power of light to the gas arc lamp by 200 per cent in proportion to the number of electric lights installed in any windows. Second, receiving the benefit of all the light he is paying for, situated where it will serve a double purpose, that of lighting his windows perfectly without having to hide it, and the further effect of lighting the street and store in front.

This is not true with the hidden electric light, constructed so as to throw the light in the window. It necessarily takes so much from the outside. You can prove this statement by looking along the side of the street you are standing upon, and a few doors from where you are it will be difficult for you to determine where there is a lighted window in the block. With the outside gas arc you know there is a well lighted window from the fact that you can see it several blocks away. There are a few narrow-minded merchants who object to the outside arc because they claim that they do not want to light the city. Don't waste time with them. Leave them to see their mistake, and when the outside arcs are started such people will soon fall in line.

Other excellent places to install outside gas arcs are on the second and third stories of buildings, just outside of the windows, where they can easily be trimmed from the window sill. Either white or colored globes can be used for this class of work, making a big hit as novelty advertising. There is located in this city, just across the street from the gas office, a French restaurant, on the second floor of which are installed four outside gas arcs with colored globes. The proprietor claims those arcs have attracted more people, to look up first, and then go up, than any other kind of advertising he could have purchased.

Last of all, let us consider the trial proposition. Is it wise to install gas arcs on trial? Yes; if you are careful. Thoroughly understand your prospective deals. Make a perfectly clear statement with reference to what you are sure your light will do in the place where it is to work, then the maximum cost per hour for burning; follow up with tact, energy and enthusiasm, and above all with perfect confidence in the successful closing of your trial orders. A gas salesman with a fair knowledge of the business, observing the above suggestions, can stick 95 per cent of all the arc lights he will install on trial. The gentlemen soliciting in this city have installed 150 outside gas arcs since last March, mostly on trial. Records show only three returns. Two of this number could not be successfully closed because the gentleman claimed he received light enough from the three outside arc lights which his next door neighbor, a druggist, who had recently purchased and since paid for under trial plan. The remaining arc was taken down on account of lack of room to use a screen door, but will be re-hung in the fall.

CURRENT COLLECTORS FOR HIGH-SPEED ROADS.*

At present the only satisfactory method of collecting large currents at high speeds is from a third rail. By large currents and high speeds is meant the collection of more than 250 amps. at 50 m. p. h. Up to this point the ordinary trolley wheel, well balanced, bearing against a catenary-hung trolley, is fairly satisfactory. The life of a trolley wheel varies, of course, with the alignment of the track and overhead construction, tension on the pole, conditions of bearings and other factors, but under ordinary conditions the average life of a trolley wheel in high-speed service is about 3000 miles. A trolley wheel will collect as high as 800 amps. at speeds below 15 m. p. h., that is, while cars are starting, but its ability as a current collector decreases with the speed until from 200 to 250 amps. is about the limit of its capacity at 50 m. p. h. These values are based upon a pressure of about 35 lbs. upward thrust.

*Reprinted from the "Street Railway Journal."

The limit of wheel capacity comes almost entirely from two causes: (1) The inertia of the wheel when striking trolley-wire supports, which, however, light and flexibly suspended they may be, still make the wheels jump at speeds approaching or exceeding 50 m. p. h.; (2) It takes only a slight unbalancing of the wheels at these high speeds to produce almost continuous arcing and hence rapid deterioration of the wheels. The remedy for this, of course, is better construction of the wheels, proper balancing, frequent inspection and turning down, and larger diameters. Tests made with trolley wheels under 18 lbs. pressure between wheels and wire indicate that with a No. 00 wire and 12-ft. pole, and at 10 m. p. h., there is a drop of about 2 volts at 500 amps., or 1 kilowatt is lost. This drop increases rapidly with the speed, so that at 50 m. p. h. the drop averages between 13 and 14 volts. At 60 m. p. h. or more the trolley wheel becomes almost inoperative with present line construction and diameters of wheels used and the usual method of trolley pole and spring base support. This condition is practically independent of the current, and is caused by the inertia and unbalanced condition of the wheel. Hence, it has been suggested that trolley wheels to be used for very high speeds should be of considerably larger diameter, made as light as possible, and very flexibly suspended.

The principal substitutes for the wheel trolley are the bow trolley as used extensively on the Continent of Europe, the pan scraper as used on some recent single-phase lines, and the roller trolley employed in one instance on the Pacific Slope. The European form of bow trolley with a scraping wire or semi-flat contact answers fairly well for slow-speed roads, but is expensive in maintenance and is practically inoperative at speeds much over 30 to 40 m. p. h., as the friction between scraper and wire is sufficient to saw through the contact in a very short time. The fair success of the bow trolley abroad is undoubtedly due to the low speeds at which the cars are run and to the consequent extremely light pressure used. It should be borne in mind, however, that great difficulty exists in maintaining contact between scraper and trolley wire at very high speeds unless considerable tension is placed on the trolley pole.

As a modification of the bow trolley a pan scraper is being used with some success in this country for speeds of about 50 m. p. h. One great advantage of the pan scraper is that it can be raised and lowered pneumatically. This is especially desirable on high-voltage lines, as it is difficult to insulate a trolley rope in wet weather so that it would be invariably safe with high voltage when used by the men ordinarily employed as conductors and motormen. Experiments with pans of aluminum alloy and also with pans made up of alternate sheets of copper and aluminum have been tried, and seem to indicate they can be used without excessive wear up to 50 or 60 m. p. h. where the current is not very large, as in a. c. operation. All things considered, the pan is perhaps the best all-round contact device for a. c. cars. Roller trolleys will carry an enormous current at low speeds, but are very susceptible to inertia at high speeds, owing to their great mass. There is but one road operating with roller trolleys in this country, and here they are considered satisfactory. The speeds, however, are moderate, 35 m. p. h.; the current does not average at starting over 600 amps. and in running over 200 amps. per roller.

From this it will be seen that the subject of current collection is still unstandardized, with the trolley wheel best suited for city and light interurban service, the third-rail shoe satisfactory where the third rail is admissible, and the pan trolley the present favorite for high-speed a. c. cars. It is safe to say, however, that with the attention which is being given to this subject there are apt to be improvements, which may materially change the situation before long.

ASPECTS OF TECHNICAL JOURNALISM.*

It sounds almost heretical to express the idea that a modern man can live without a daily newspaper, but Lord Kelvin once allowed to me that he virtually did so without cheating his brain. The placard bulletin, the megaphone, the ticker tape, and the sky signal-lights could keep one fairly "au courant" with all the news of plague, famine, and sudden death that is necessary to happiness. But it is hard to conceive how a man desirous of keeping abreast of invention, improvement, experience, and discussion in his profession or industry can possibly do so if he does not read with at least moderate diligence his technical paper. Even the worst trade journal is better than none; and the best will leave a true hunger for knowledge sorely unsatisfied. The technical journalist is a specialist, he is cultivating a restricted territory, he is working with a microscope, all of which tells against largeness, broadness, liberality. Yet intensified cultivation has its merits, and many a patch of lilies in Bermuda, or vines in France, yields a far more valuable product than a sprawling wheat farm in Minnesota with its thin 15 bushels to the acre.

No technical man can find outside his special class journal the right intellectual food—tough, indigestible, and badly cooked as most of it may be. The efforts of the daily press to be technical and supply valuable data, are laudable; the engineering supplement to the "London Times" is the best example of how far such a tendency can go; and the synopses given in many American journals of scientific and industrial news are praiseworthy from the standpoint of the average reader. But much of what gets into print thus is to be regarded with suspicion, though reflecting no discredit on the daily whose pages it brightens. Now and again there is a book in the nature of a revelation, but the majority of the text-books in our schools and on our shelves are years behind the latest things going. These facts the student, in college or out, must get from the technical press. Being often asked for the latest book on a subject I have been struck with the frequency, the invariability with which one's recommendation unavoidably carries with it a number of articles recently printed in the technical press.

From the industrial or commercial side, this necessity for the class journal seems to be equally pronounced; some people might regard it as even more accentuated. The copper quotations of the "Engineering and Mining Journal" are cited everywhere, being cabled to Japan, for instance. The price lists of the "Iron Age" are a necessity of life to thousands of hardware merchants all over the country, who but for the quotations on hundreds of articles in that useful paper would have to consult and compare endless special bulletins from manufacturers and jobbers. When Mr. Carnegie a few years ago opened the library at Braddock, Pa., he warmly advised the careful reading of the trade press; and in his suggestive lecture on business at Cornell University in 1896, he remarked: "You see, gentlemen, the business man of this day has to read, yes, and study, and go to the root of many things, that he may avoid the pitfalls that surround business on every side." In other words, the technical journal is an essential tool of professional, industrial, and commercial life.

When I meet a young engineer and discover that he has, unless for some valid reason, failed to join the national or local society of his branch of engineering, I find myself involuntarily putting a black mark against his name. When I discover also that he does not read regularly the journals of the art, he becomes more hopelessly "conditioned" in my mind, as one without professional pride and dignity, and as one who on his own confession does not keep himself so informed about progress that he can be properly useful in the world.

I have been formulating a plea or reason for the existence of technical journals as the clearing houses of current knowledge, as a necessary tool, as a means of intercourse, without any implication that any one of them is all that might be expected of it. Every human institution is branded with imperfection, and it is only of late years that most technical journals have even begun to attack the tasks before them or discharge the responsibilities resting upon them. Aside from the conceded inadequacy of the editors and managers—nowhere more painfully realized than among themselves—two very great difficulties steadily prevent these luminaries from being of full candle-power. One of these is the inability to find men who have a story to tell and who can tell it well. The other is the reluctance of corporations and individuals to make public for common benefit the information acquired primarily for themselves in dealing with a subject, and often at enormous expense. Both these are evils and may be glanced at separately.

It may appear curious in these days when it is supposed that everybody writes to complain that there is not writing enough. Lady Holland once said to Lord Porchester: "I am sorry to hear you are going to publish a poem. Can't you suppress it?" And when one wades through the countless popular magazines, and the endless Sunday newspapers, and realizes how many beautiful miles of the forest fall daily under the axe to supply food for the ravenous presses of the age, it does seem as though the whispering trees would be better than so much loud talk. But as sinners against the Adirondacks, the technical papers are venial offenders with their little editions, when compared with "yellows" boasting half a million copies daily, or "muckrakers" running a million a month. Those outlets for the productions of the intellect are always clogged with copy, but the technical journals in reality have little offered them voluntarily, and are frequently at a loss to get the right man to deal with a topic. For some inexplicable reason, the phrase "an officer and a gentleman" does not find its equivalent in "an engineer and an author," although the engineer almost daily has an experience or an observation which if duly recorded would be of value and economy to every one else in the same field of work; and even if the single fact is of little utility, a number of them might permit the generalization out of which great truths and great inventions would presently emerge.

If the technical journals could get more of these articles, they would pass in glad silence over the fact that the authors knew little of prosody or syntax, and have never used any but "simplified spelling." The great want of the time is, indeed, the ability to observe and then tell clearly and directly what is seen. This whole great electrical field of ours teems with obscure phenomena, with hints, suggestions, ideas, so that if a man notes something and does not know himself how to make use of it he can at least be useful by passing it on. There may be an improvement or a refinement in the art involved in the merest trifle; there may be the germ of a great invention. Chiefly thus does the improbable or the impossible become the prosaic and commonplace. "Numerous attempts have been made," said Herbert Spencer in his treatise on Education, "to construct electro-magnetic engines, in the hope of superseding steam, but had those who supplied the money understood the general law of the correlation and the equivalence of forces, they might have had better balances at their banks." These very works are building yearly thousands of dynamo-electric machines that supersede steam in every branch of industry, but the process of their creation since Spencer wrote, down to the moment when No. 6000 went on the Central tracks, has been one of almost imperceptible gradations of advance; and each advance has involved one closer observation of the conditions and facts to be dealt with in solving the problem. Such data are the very pith and marrow of the technical journal, and while I yield to none in profound admiration of the creative inventor—Edison, Thomson, Rice, or Steinmetz—I become more and

*Extracts from an address before the Schenactady Branch of the Institute, October 5, 1906, by T. Commerford Martin, Past President and Editor of the "Electrical World."

more convinced that in large measure the magnificent growth during the past century in the arts and sciences is due to the swift printing and circulating of new knowledge, which even to the genius is stimulating food for thought.

Perhaps there might be more encouragement for such writing if it paid better. True. In this respect the technical field, with its small editions, cannot compete with the daily paper or the popular magazine. I know something of the affairs of four technical journals, and in not one of them does the subscription price begin to pay for the mechanical cost of production—the paper, press-work, ink, and binding. Obviously the margin for the intellectual cost cannot be very great; and it is not. I have never known a millionaire among trade-press publishers; I have never known one who did not stick close to his job, working strenuously day in and day out to build up and conserve the business and the paper. The fact is, the contributor to a technical journal, like the author of a paper, must not overlook what we may call the "earned increment" that comes from publicity, enhanced reputation, and the wonderful usufruct that flows in upon us every time we do a public service or a disinterested act. It is pertinent and not impertinent to recall here that my own introduction to Mr. C. P. Steinmetz was through an article that he thought, with characteristic modesty, my paper might like to publish. The paltry dollars we paid him were all we could afford and draw our own little weekly stipend, but at least we did give him at once an audience that has ever since grown larger and more appreciative of his worth.

Roughly, possible writers for the technical press are grouped into men who could not and men who must not, leaving editors a very narrow range of collaboration. In other words, it is often to the interest of a great corporation to keep its mouth shut, and the casuistry of that situation has frequently caused me hours of perplexity. It all gets back to the old question of morals and sociology, how far a man has a right to that which is his own.

The fact that an important matter is not mentioned by the technical press does not imply ignorance of it. This year I published an article in regard to an important invention of which I had had knowledge for at least four years. During that time not one word had I printed about it. The list of the recipients for the Carnegie medal for heroism ought really to include people who, under temptation, hold their tongues. Sometimes, things leak in a mysterious way, sometimes in a nefarious way, but it may be questioned whether the case is on record of a technical editor who took, or paid for knowingly, the story of an employe giving away the confidential secrets of the company he had been serving. It could not well be otherwise. It is not a question of fear of losing advertising patronage. That is curiously exaggerated in the public mind. I do not know a technical journal that could not lose the advertising patronage of half a dozen of its largest patrons without the slightest financial injury in the long run. Of course a whole industry might go to pieces, as did the bicycle trade, crippling a dozen good journals; but the best of them survived, or were transmogrified into the automobile field. There was a time in the electrical field when my own journal had something like 30 separate arc-light companies, each advertising largely its own system. They were virtually all absorbed, or faded away, but the art went on, and so did the paper. The truth seems to be that where there is consolidation of effort in any permanent and growing field, the concentration, if justified, brings with it economies and new wealth, and that wealth has to find an outlet again in new industries. There would have been no telephony, if telegraphy had not been profitable. The electric light was encouraged by the telephone boom, and the electric railway sprang from the success and resources of illumination.

Most large corporations have their publicity or literary bureaus, which do deft, clever work of a high informational value, resulting in the diffusion of a great deal of useful data of benefit to everybody in the art.

The only objection to the present prevalent plan of spreading the same article profusely broadcast is that it becomes mutilated or emasculated because self-respecting papers object to print the same "story" verb et lit, just as though it were a mere electrotype. The other plan of inviting the editors to inspect a new appliance, and then give their own version, is better, even if they get it a bit wrong. One popular plan which has many obvious demerits is the modern house organ, where a corporation can say what it wants as it likes, and vaunt itself to the skies as to any new plant or product. Everybody discounts that kind of publicity immediately, and it carries no weight, even as compared with the issuance of exactly the same matter in a venal journal that makes a living by printing "write-ups." It is exactly the same kind of discount that an electrical journal is involuntarily subjected to by a general reader who peruses its advocacy of something electrical as preferable to something that is not. In the final analysis what we are all seeking is the truth published without bent or bias, without fear or favor.

Finally a brief note on the journalist himself, the composite, mystical, elusive "we." More and more the "we" becomes a reality, however such a strong personality will assert itself and breathe in palpable form through the cold type, or exhibit itself in that exquisite thing called style. Without parading all the secrets of the prison house, I can say that in the paper with which I come in nearest touch, an editorial expression of opinion is very rarely that of one man. It is more often a blend, like good whiskey. One hand will contribute the fundamentals, others will furnish the harmonics and over-tones; and when the editor who has least to do with it is complimented on his last admirable production, he will acquiesce in silent pride and complacency.

The California Promotion Committee is offering an excellent opportunity to every county in this State to give its local resources a wide publicity. It is the intention of the Committee to publish in its magazine, "For California," a series of articles descriptive of the advantages and possibilities of every part of California, and to that end it has asked commercial organizations and clerks of the Boards of Supervisors of every county to contribute articles of such a character so that they will be written by men familiar with local conditions.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.

The fourth annual meeting of this Association will be held in New York City, Tuesday and Wednesday, December 11 and 12, 1906. Headquarters will be at the Hotel Astor, Forty-fifth and Broadway.

Tuesday, the 11th, will be devoted to the business of the Association. The meeting will be called to order at 10 a. m.; luncheon will be served at 1 p. m. The banquet will be held on Tuesday evening in the banquet hall of the Hotel Astor.

Members are urged to communicate with the hotel at once with reference to accommodations.

It is anticipated that this meeting will be the largest one ever held since the organization of the Association, and as many interesting and important subjects will be presented for discussion, every member should arrange to have at least one representative.

The JOURNAL OF ELECTRICITY POWER AND GAS
WITH WHICH IS INCORPORATED
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EDITORIAL.

THE MANUFACTURE AND USE OF GAS

The modern methods of gas manufacture are primarily responsible for the reduced cost of gas as a fuel and also for purposes of illumination. While the cost of gas in the holder depends very largely upon the capacity of the plant, yet in the early days of the gas industry when coal gas only was used, the cost of fuel was high and the capacity of the plant small when compared with the first cost of the installation. The substitution of crude oil instead of coal, as well as other changes in the design of gas manufacturing apparatus has in many instances resulted in the substitution of gas for fuel in place of coal or oil.

Taking into consideration the many advantages incident to the use of gas, it is decidedly a cheap fuel. Ease of transportation to the place of utilization gives gas a decided preference over solid or liquid fuels. In addition, gas has a higher temperature of combustion, and generates a larger quantity of gaseous products during combustion than other fuels of the same composition. The result is a much more economical use and application of the heat of combustion.

Natural gas or gaseous fuel in nature is unfortunately limited in quantity and not widely distributed. On the other hand, solid fuel such as coal is not only abundant but may be found in almost all quarters of the globe. Liquid fuel such as crude oil is less abundant than coal and not so widely distributed. Nevertheless, in recent years liquid fuel has taken the place of coal wherever available.

The heating value of the best natural gas is excellent, the composition being in general about 65 per cent to 70 per cent methane, 20 per cent to 25 per cent hydrogen, small quantities of nitrogen and ethane, and very small portions of carbon dioxide and carbon monoxide.

Artificial gas is manufactured from solid and liquid fuels by the three following processes:

1. By the dry distillation of solid fuel containing carbon, from which the gases of distillation are obtained, the gas thereby produced being known as coal gas.

2. By the incomplete combustion of solid or liquid fuel containing carbon, such as coal or crude oil, with an insufficient amount of air present for complete combustion. The gas so manufactured is commonly called producer gas.

3. By the decomposition of water, usually in the vaporized state, or steam, by glowing solid fuel, producing what is commonly known as water gas.

There are two other special methods for the manufacture of fuel gases, the first being the incomplete combustion of coal by the simultaneous action of air and oxides, This process takes places in blast furnaces of iron ore, the oxides being reduced, and produces a gas of high fuel value, low in nitrogen and containing a large per cent of carbon monoxide. The second process produces a gas of very high illuminating power from calcium carbide, which gas is ordinarily known as acetylene. The blast furnace and acetylene gases are not manufactured on a large scale except for special application.

It must be remembered that the product of any particular process may and often does give a mixture of the gases indicated above, but the use to which the gas is put will in general determine the method of manufacture. Gas for illuminating purposes generally involves the greatest cost of manufacture, but this cost will depend materially upon the cost of fuel.

As a comparison with natural gas, a fair illuminating gas contains from 50 to 55 per cent hydrogen, 30 to 35 per cent methane, 5 to 10 per cent carbon monoxide, and 2 to 3 per cent carbon dioxide. The analysis of producer gas or water gas will largely depend upon the details of manufacture, the composition being subject to wide variations.

Now that gas is used so largely for power and fuel, it is coming to be the practice to manufacture different grades of gas, supplied by separate distribution systems for light, fuel and power. The details of gas manufacture are being rapidly developed, and within a very short time the best gas for each individual user will be available, and the amount of gas used will be very greatly increased.

BOOK REVIEWS.

The Report of New Business Methods to the American Gas Institute, which held its first meeting in Chicago on October 17th, 18th and 19th, fills a 281-page book which is well worth a careful reading by every enterprising gas man. "How to get new business and hold it," might consistently be written on every page. The first half of this book contains

a series of brief pointed articles by men actively engaged in the gas industry who know whereof they speak. The concluding half is given over to reproductions of newspaper, magazine and other ads., which stand out as effective examples of good gas advertising.

TRADE CATALOGUES.

The St. Louis branch of the H. W. Johns-Manville Co. is sending out a folder telling all about asbestos fire-felt locomotive lagging and train pipe covering.

The Lima Insulator Company, Lima, N. Y., is sending out three bulletins descriptive of high voltage porcelain insulators. Bulletin No. 36 describes a two-piece insulator designed for an operating voltage of 35,000. Bulletin No. 33 deals with a three-piece insulator also designed for a normal voltage of 35,000. Bulletin No. 422 describes a three-piece insulator suitable for high tension lines of 45,000 volts. Each bulletin contains an excellent photograph and a sectional drawing of the insulator described, together with dimensions, shipping data, etc.

To facilitate the ordering of repair parts for electric railway apparatus, the General Electric Company has published a 234-page catalogue, bound in cloth, which gives the sizes, catalogue numbers and list prices of the various parts which make up the car and pole equipments. Like the rest of the General Electric Company's literature, this book is amply illustrated.

The merits of "Mobilene" sheet packing and "Kearsarge" asbesto-metallic coil packing are again being brought to the attention of those interested by two flyers issued by the manufacturers, the H. W. Johns-Manville Co., whose local offices are at 180-182 Second street, San Francisco. "Mobilene" packing is for the cylinder-head joints of gas and gasoline engines. The "Kearsarge" is a high pressure piston-rod packing suitable for high speed engines.

The air-brake department of the Allis-Chalmers Co., Milwaukee, Wis., has just issued Bulletin No. 1508, which describes in detail the construction and operation of Christensen Straight Air-Brake Equipments for cars operated singly or in trains. The Allis-Chalmers Co. has obtained from Mr. Christensen, the inventor, the sole right to manufacture and sell devices based on his recent patents on air-brakes and air compressors.

The Thanksgiving bulletin of the Portland General Electric Company shows some of the striding applications of electricity to lighting and domestic purposes. Two half-tones give some idea of the brilliant effect obtained by uisng specially arranged electric lighting outfits as accessories to table decorations. The bulletin is primarily devoted to the lighting of stores, show windows and offices; and like its predecessors is well illustrated.

The well known publishers, Munn & Company, 361 Broadway, New York, has issued an extensive catalogue of the scientific and technical books which they publish or for which they are agents. These cover pretty thoroughly the various branches of engineering, and the technical arts as well as the theoretical sciences.

PERSONAL.

Mr. H. B. Kirkland recently resigned his position with the American Circular Loom Company of Chelsea, Mass., for whom he was general sales manager.

Mr. Arthur Williams, President of the National Electric Light Association, has appointed a committee of five representative central station managers to co-operate in the development and execution of the plans of the Co-operative Electrical Development Association. The Committee consists of the following: W. W. Freeman of Brooklyn Edison Co., chairman; John W. Gilchrist of Chicago Edison Co., R. S. Hale of the Boston Edison Co., J. E. Montague of the Buffalo & Niagara Falls Electric Light and Power Co., and F. M. Tait of the Dayton Lighting Co. This committee will hold several conferences with other committees representing the manufacturers, jobbers and contractors of electrical supplies, the technical press, and advertising agencies preliminary to the joint committee meeting which is to be held in New York within a few weeks. It is expected at this meeting to finally complete and agree upon an effective scheme of organization for 1907.

ELECTRIC POWER TO RID LONDON OF SMOKE.

A plan has been proposed by Arnold Lupton, a member of the British Parliament, the object of which is to do away with the burning of fuel in London. The plan contemplates the use of electric power for heating, lighting and cooking in London, the power to be brought from the coal fields of the Midlands. In this way all furnaces and smoke producers will be driven from the city. It is estimated that the smoke nuisance causes actual damage every year amounting to about $10,000,000, and this does not include any allowance for the personal discomfort which it causes. The idea is not only to do away with this nuisance, but to supply the power on such a scale that it will be a cheap substitute for the present source of light, heat and power.

The plan proposed contemplates the transmission of electrical energy from the Midland coal fields, 120 miles away from London, at 60,000 volts. The average power to be supplied is about 1,000,000 kilowatts. Mr. Lupton estimates that, if done on this scale, power could be delivered in the city at one-half cent per kilowatt-hour and could be delivered in smaller quantities at a rate of two cents and in larger quantities for less. It is also estimated that it will cost about $17,000,000 to make a beginning. Mr. Lupton thinks that this would make London one of the sunniest cities on the globe, as well as the most beautiful city in the world.

THE COMING CONVENTION OF THE CALIFORNIA MINERS' ASSOCIATION.

The annual convention of the California Miners' Association will be held this year in San Francisco, on December 3d, 4th, 5th and 6th. The influence of the Miners' Association in promoting the mining industry in this State has long been felt. The coming meeting promises to be an unusually interesting one, as the Executive Committee is assued of some very interesting papers. A large attendance is looked for.

The original edition of the annual proceedings, devoted to last year's meeting, was destroyed in the April fire. A reprint has just been gotten out, and copies are now ready for distribution.

GAS ENGINE TEST.

At a recent test of the Wile suction gas producer and two-cylinder Jacobson automatic gas engine, the following results have been reported:

On a ten-hour run, with a load of 39.4 K.W., using pea coal of calorific value 13,465 B.T.U. per pound, the total consumption was 624 pounds, or 1.59 pounds per K.W hour. Under the conditions of operating with a belt-driven generator it was estimated by the engineers in charge of the test that the B.H.P. was 67.75, so that the coal consumption per B.H.P. hour was .92 pounds. On a test for overload a maximum load of 47.5 K.W was carried. The producer was charged with fuel at starting and once during the run, seven hours after starting. The plant has now been in operation for over two months and has been highly satisfactory in every respect.

INDUSTRIAL

THE PELTON WATER WHEEL CO.

The first modern machine shop to be erected in San Francisco since the fire of last April and which is now in running order is that of the Pelton Water Wheel Company located on the block bounded by Harrison, Alabama and Nineteenth streets. This company was completely burned out in its former location on Main street, but was fortunate in having, prior to the disaster, planned and contracted for its new works, and although erected under the emergency conditions immediately following the fire, it is not a collection of temporary structures by any means, but is of most substantial construction throughout. The design and equipment is the result of careful study, and for its capacity represents one of the best equipped plants in the country today, being intended as the permanent home of this enterprising concern.

EXTERIOR OF PLANT, SHOWING SPUR TRACK.

The main machine shop is 124 feet 6 inches wide by 180 feet long, and is devoted exclusively to machine work on water wheels and hydraulic accessories.

This building consists of two bays, each 62 feet 3 inches wide, and 40 feet high to the bottom of the roof trusses. The columns of the main row consist of a 16x16-inch with a 12-inch timber on each side, spaced 20 feet centers, each supporting one end of the roof trusses. The 12x12's on each side of the 16x16-inch timbers are bolted through and form a double row of crane track supports for one side of each bay. The crane tracks of the main bay are located 34 feet above the floor, and the crane has the entire run of 180 feet, reaching within 3 feet of each side wall and 5 feet of each end wall, thus covering a floor area of about 10,000 square feet, and reaching all of the motor-driven tools. The second machine bay is equipped with a crane track 20 feet above the floor and running the entire length of the building. The main crane track is located on 24-inch I beams, and the secondary crane on

15-inch I beams, all supported on the above mentioned 12x12 posts with 20 feet centers. The second bay is arranged with the crane lower than in the main bay, admitting of a second floor being placed over the crane, thus affording space for the pattern shop, drafting room and office.

Separated from the main building by a 20-foot driveway is a two-story pattern annex 62 feet 3 inches wide by 75 feet long, being an exact continuation of the second bay of the main shop, so that the main building may be continued to a depth of 275 feet when desired. This building is fitted with an elevator for the convenient handling of large patterns to the second story.

Separate from the above buildings is the blacksmith shop, 32x40 feet, with a forge and full set of blacksmith's tools, babbitting ladles, and other equipment.

All the buildings are covered with heavy gauge corrugated galvanized iron laid with extra lap and galvanized nails. Each 20-foot section of roof is provided with four 8x16-foot lights with wire glass, and sides and ends of building are fully glazed, furnishing unusual illumination. The engineering architects, Messrs. Cory, Meredith & Allen, were actuated by the theory that light was one of the prime requisites of a machine shop, and all material was fully whitened with protective coating, affording complete diffusion of light.

PORTION OF MAIN BAY OF MACHINE SHOP, LOOKING NORTH.

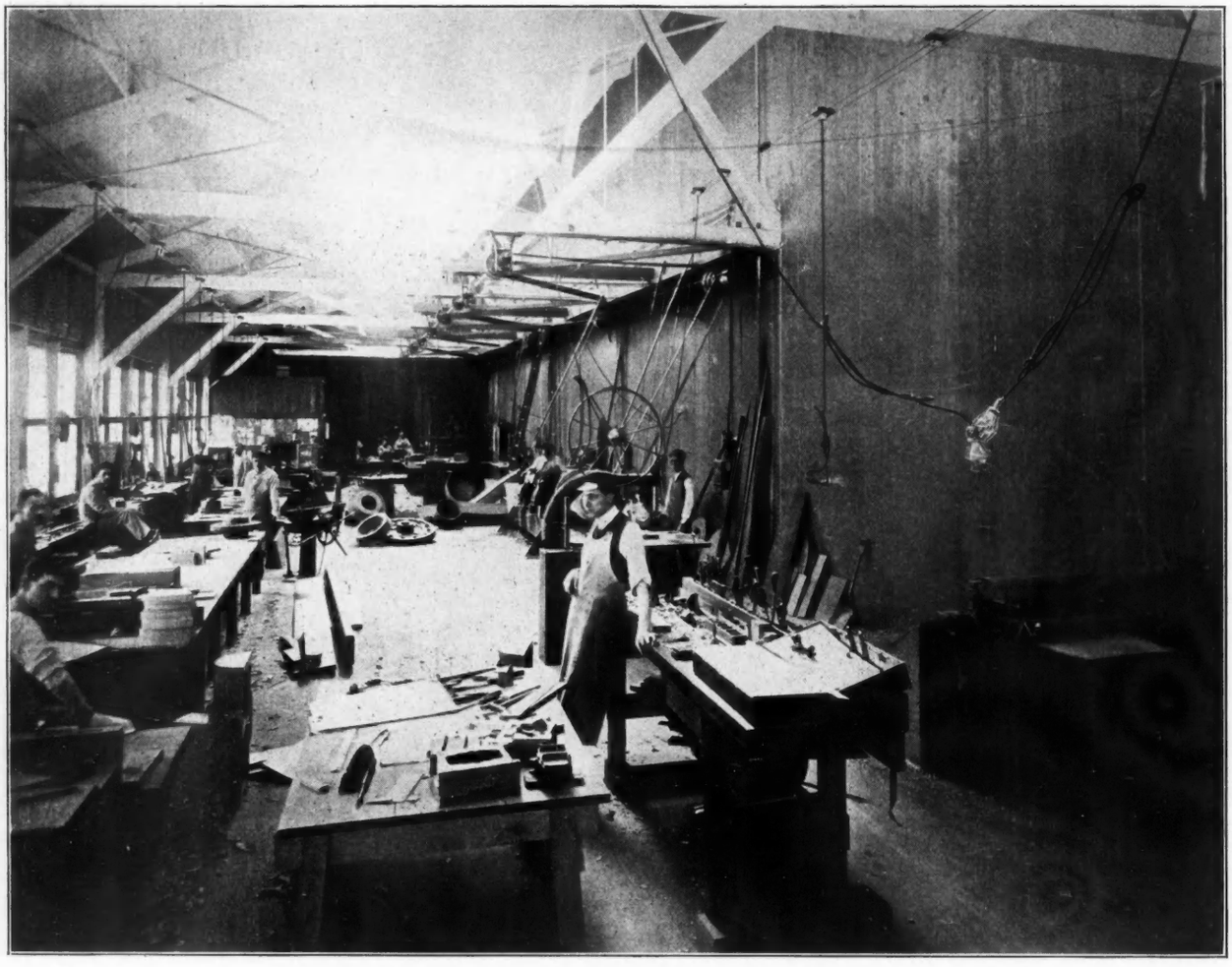
A hydraulic laboratory of particular interest is located in the pattern annex, and is now being fitted up with special apparatus for the investigation of bucket and nozzle curvatures, provision being made for constant gravity and pump pressures, pony brakes, chronographs, mercury gauges, electrical recording apparatus, etc. The same line of interesting investigations previously reported (see Journal of Electricity, Power and Gas, Vol. 13, No. 8) will be continued. In this building is also located, temporarily, a special bucket milling apparatus for machining, with mathematical accuracy, buckets for the Pelton water wheels.

The machine shop and blacksmith buildings are located near the railroad track, and a freight spur runs into the main bay, the cars being fully covered by the crane. The main building is equipped with nine Kinnear doors, eight being 12x12 feet and one 22 feet by 18 feet 6 inches, and is so arranged that teams may drive through. The yard is also arranged with gates on each street with a driveway through from side to side.

The floor has received special attention, and is constructed in the following manner: All loose fill was removed, the surface in fact being cleared to hardpan. On top of this,

good clean sand mixed with sharp rock was puddled, dried out and capped with a heavy layer of concrete, in which were set nailing strips on 2-foot centers carefully leveled. The top layer of cement was scraped flush with the nailing strips, and 2-inch planking was then spiked to them, on top of which was laid a 1-inch cedar floor cross grained in relation to the lower. The concrete floor was laid flush with the tops of piers and connecting walls, thus making a single machine floor of 124 ft. 6 in. x 180 ft., or over 22,000 square feet of surface. A store room 60x36 is located on the mezzanine floor with shipping department immediately below.

Machine Tools—The fact that the former tool equipment



VIEW OF PATTERN SHOP LOOKING SOUTH.

was entirely destroyed made possible the installation of a complete equipment of modern machine tools, orders for which were telegraphed to the prominent machinery dealers within a week after the fire.

Following the modern practice, countershafting and belting has been almost entirely eliminated as being inefficient and expensive of maintenance. Each individual tool, as far as possible, is equipped with its independent induction motor, direct geared through a variable speed gear box, thus giving absolute control. In the case of the smaller light tools where an independent motor is impracticable, these are divided into groups and driven by a countershaft having its own motor. In addition to the large boring mills, lathes and planers may be mentioned an 8x8-foot Bickford radial drill and special 6-foot horizontal boring, milling and drilling machine; a 36x36-inch and a 48x48-inch x 16-foot open side planer; special grinding machinery, consisting of Gisholt lathes and planers, tool grinders, Wilmarth & Morman drill grinders, together with the usual equipment of wet and dry grinding tools, and special bucket grinding machines. For fine tool work, such as jigs and gauges, a large Landis grinder completes the equipment in this regard. A Cincinnati milling machine with a full line of cutters for fine tool work is also installed. The tool room with high speed steel drills, reamers and core drills in all sizes up to 3-inch, with a full set of U. S. standard taps and dies, is centrally located in the machine shop. A complete set of micrometers up to 24-inch is provided, also Brown & Sharpe spherical test gauges, limit gauges, welding and annealing furnaces, etc. Many special tools for the construction of high grade water wheels may be mentioned, such as special milling machines, grinding machines, automatic turret lathes, automatic turning tools and special jigs for making all parts of machines, so that shafts or buckets, bearings or wheel centers, nozzles or gate

valves may be duplicated at any time. The crane is a 10-ton 3-motor electric of Niles make, with 20 horsepower high speed hoist, 8 horsepower trolley and 15 horsepower bridge motors, all operated from the crane cage. The crane is operated under 220-volt, 2-phase A. C. service, and is the first induction motor crane in San Francisco.

Pattern Shop—The pattern shop is 110 feet long by 131 feet wide, and is arranged for the easy accommodation of sixteen patternworkers, with a full set of high grade wood working tools. A large stock of pattern lumber is kept on hand to insure of its being properly seasoned for use in the construction of all patterns except those for standard products which are made up of aluminum, brass or iron.

Drafting Room—This is 60x31 feet with the usual full equipment of labor saving and filing apparatus and cabinets, and in addition is provided with blue print room, dark room, photographic laboratory, etc. The office is equipped with all the latest and best known filing and recording systems, and the usual furnishings to insure comfort and ready reference. This company was fortunate in having saved from the fire its complete drafting room records, including drawings, tracings and specifications so essential to a manufacturing establishment. A complete system of arc and incandescent lighting enables the operator to work to as good efficiency by night as by day, and the works have been running overtime, and in some instances all night for the past three months.

This company, in addition to its specialty, water wheels and hydraulic machinery, does a general machine business, and its facilities being of the best, is prepared to turn out high grade machine work of any character.

MAIN BAY OF THE MACHINE SHOP, LOOKING SOUTH.

ELECTRIC VS. AIR DRILLS.

Recent comparative tests between two electric drills equal to any put on the market, and two air drills operating at eighty pounds' pressure showed the latter to be much more efficient. The air drills were in actual use 317 hours, during which time they drilled 1,279 feet, or an average of four feet per hour, and were not stopped at any time for repairs. The electric drills were in operation 100 hours, drilling in that time 253 feet, an average of 2.55 feet per hour, and were laid up for repairs for seventeen hours. The work was done on black diabase during fifty-three consecutive ten-hour shifts.

THE COPPER MARKET.

According to the latest issue of "Copper Gossip," which is published by the National Conduit & Cable Co., the price of copper is still climbing skyward. During the past thirty days electrolytic wire bars for future delivery have advanced from 19¼ to 21½ cents a pound. The production of copper for the first nine months of this year in the Lake Superior districts is estimated at 168,891,200 pounds, and in Montana at 279,339,000 pounds. The total exports of copper for September is given at 14,119 tons, and the imports as 8,500 tons. Figures for the month of August put the exports at 20,433 tons, and the imports at 8,340 tons.

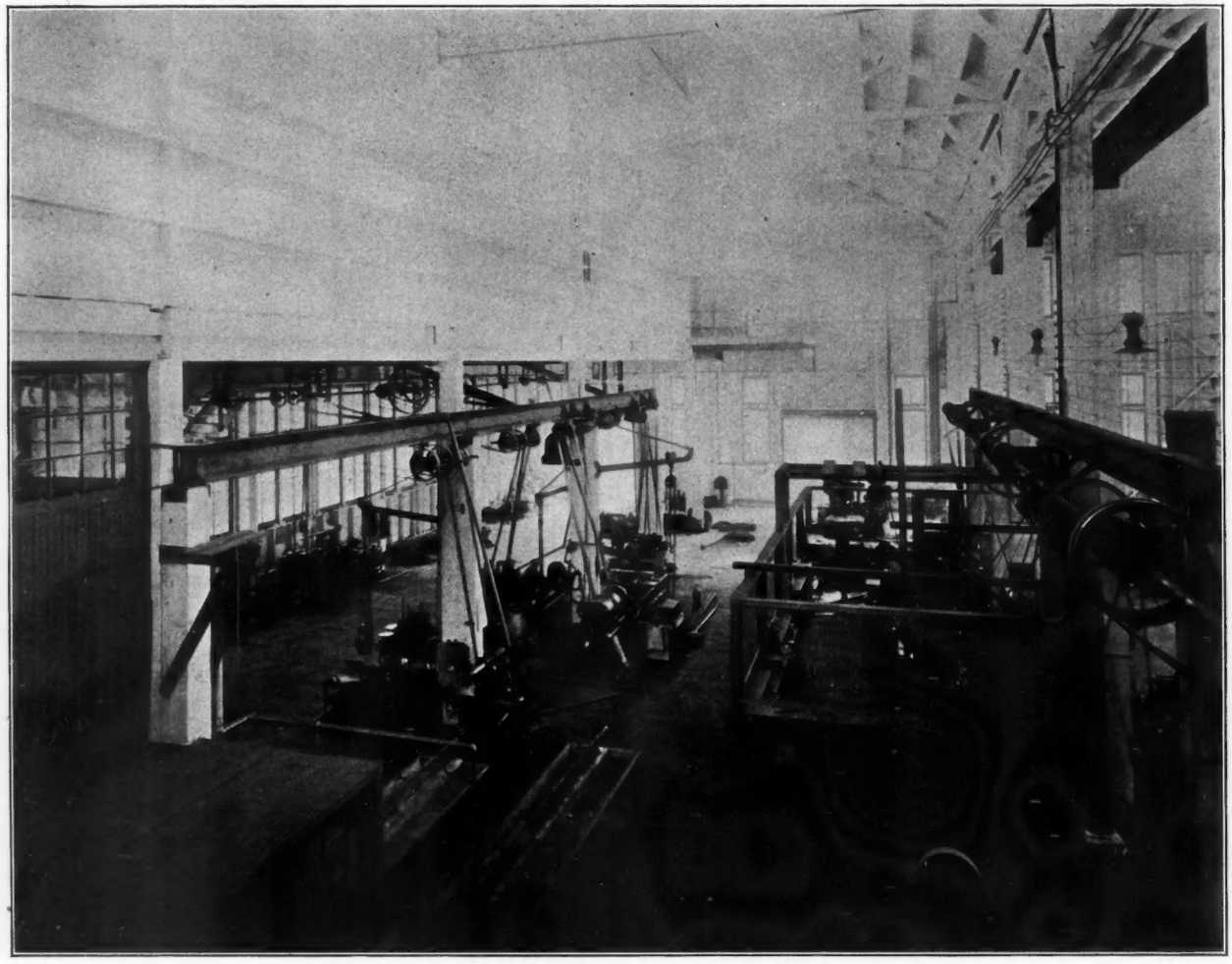
it is in a position to fill promptly all orders for air or gas compressors, rock drills, etc., also for general machine work.

The De la Vergne Machine Company, foot of East 138th street, New York City, has just issued a folder describing the Klein water cooling tower built by them. These towers will cool the water to from 5 to 15 degrees below the temperature of the atmosphere.

OIL BURNING LOCOMOTIVES IN MEXICO.

The Mexican Petroleum Company is now supplying to the Mexican Central railway fuel oil to the value of $2,000 a day. It is said that the Mexican Central is saving about an equal amount by the substitution of oil for coal.

The work of equipping locomotives for oil burning is being pushed as rapidly as possible in the Agua Calientes shops. During the next several months the Mexican Central will receive a large number of oil-burning locomotives from the United States. Storage tanks are being erected on the Guadalajara and other divisions of the system. It is probable that within a year the Mexican Central will be able to make a complete change from coal and wood to oil on all lines of the system, and oil to the amount of 8,000 barrels daily will be then required.



CORNER OF MACHINE SHOP SHOWING TOOL ROOM.
PELTON WATER WHEEL CO.

REMOVAL NOTICE.

The Pacific Elec. & Mfg. Co., of which Mr. Jos. S. Thompson is manager, has removed its San Francisco office from 1161 Howard street to Room 701 Atlas Building, 604 Mission street, near Second, in order to be nearer the electrical center.

The Rix Compressed Air and Drill Company is now occupying its new offices at 219-221 Spear street, San Francisco, where the main office and salesroom are also located. The factory and warehouse, as well as a branch office, are situated at 1436 Fifth street, Oakland. The company announces that

ELECTRICAL DEVELOPMENT COMMITTEE.

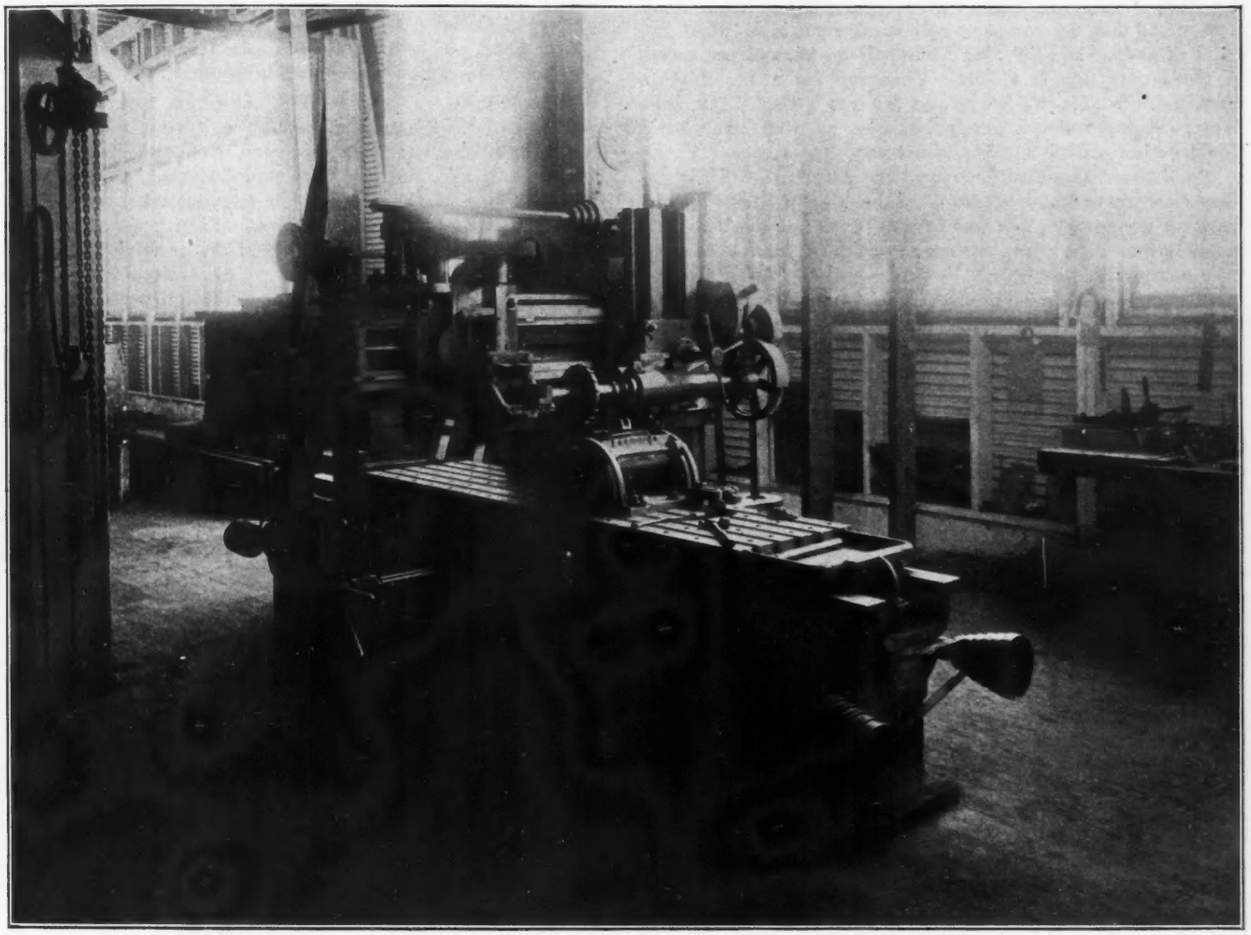
The committee on organization of the Co-operative Electrical Development Association, which is to meet shortly in New York as announced in last week's issue of "The Journal," will consist of the following representative men:

W. M. McFarland, acting president, Westinghouse Electric & Manufacturing Co.; E. M. Herr, first vice-president, Westinghouse Electric & Manufacturing Co.; L. A. Osborne, second vice-president, Westinghouse Electric & Manufacturing Co.; J. S. Anthony, General Electric Co.; Anson W. Burchard, assistant to the president, General Electric Co.; J. R. Lovejoy, manager, Railway, Lighting & Supply Dept., General Electric Co.; Walter Cary, manager, Sawyer-Man Electric Co.; A. D. Page, manager, Incandescent Lamp Sales, General Electric Co.; F. S. Terry, first vice-president, National Electric Lamp Co.; Gerard Swope, manager, Power Apparatus Dept., Western Electric Co.; O. A. Stranahan, sales manager, Allis-Chalmers Co.; W. C. Bryant, manager, Bryant Electric Co.; F. J. Newbury, John A. Roebling's Sons Co.; A. T. Clark, secretary, American Circular Loom Co.; E. E. Jackson, Jr.; Arthur Williams, president, National Electric Light Association; W. H. Blood, Jr., Stone & Webster; W. W. Freeman, Edison Electric Illuminating Co. of Brooklyn; J. F. Gilchrist, assistant to the president, Chicago Edison Co.; R. S. Hale, Edison Electric Illuminating Co. of Boston; J. E. Montague, general manager, Buffalo & Niagara Falls Electric Light & Power Co.; F. M. Tait, Dayton Lighting Co.; F. Bissell, president, F. Bissell Co.; James R. Strong, president, National Electrical Contractors' Association; Francis Raymond; J. Robert Crouse.

It will be observed that the manufacturing, central station, jobbing and contracting interests are well represented. Representatives of the technical press have not yet been selected.

MOUNTAIN TELEPHONE LINE.

An interesting telephone line has recently been erected on Greylock Mountain, Adams, Mass. The line is built on poles to the base of the mountain, where the wires then run through an inch steel pipe. The pipe is strapped to the solid rock in the center of a large landslide that occurred some yeas ago. The steel straps are riveted to the rock, holes having been drilled for that purpose. There are 2,800 ft. of wire in the pipe. At the top of the landslide the wires come out of the pipe and are strung on poles to the summit. The poles used on top were cut there, and are of spruce. Some of them are set in 6 ft. of solid rock. In the pipe that is on the slide there are hand holes 300 ft. apart to permit of repairs. They have coverings like a lid. To provide earth wires against lightning, two poles at the base of the fallen rock are set in 8 ft. of water, and about 50 ft. of wire is coiled about to take the discharge of the lightning should it attack the line. Mountain climbers are warned against using the pipe in climbing, especially during thunder showers, when they might receive fatal shocks.



SPECIAL BUCKET MILLING MACHINE.—PELTON WATER WHEEL CO.

News Notes.

ILLUMINATION.

Oak Park, Cal.—Sealed bids will be received by the Supervisors up to November 16th for the lighting of highways, streets and avenues of Oak Park, Oak Grove and Highland Park, for the term of two years, in accordance with plans on file with W. B. Hamilton, clerk.

Folsom, Cal.—Sealed bids are being received by the Supervisors of Sacramento county for furnishing and installing sixteen candle incandesent lamps in the town of Folsom, for the lighting of the streets, according to plans on file with W. B. Hamilton, clerk.

Santa Fe, N. M.—At a recent election at Cralsbad, N. M., the citizens voted in favor of granting a gas franchise, and it is expected that the company will at once put in its plant.

Redlands, Cal.—W. M. Campbell petitioned on behalf of the Home Gas & Electric Company for a franchise to erect poles and string wires and lay gas mains. The company wishes to do a power business as. well as lighting Construction work is already under way.

Whittier, Cal.—Fire destroyed the major part of the gas plant here, owned and operated by the Edison Electric Company. A temporary plant was at once started and will soon be in operation. The plant destroyed was new, having recently been completed.

Chihuahua, Mex.—The State Government has awarded a concession to J. P. McKenzie of this city for the establishment of a gas plant, and it is expected that a company will be organized to put up the plant, which is to supply gas to the city of Chihuahua.

Pasadena, Cal.—Sealed proposals are being received by the Mayor and City Council for furnishing all or a portion of the materials and equipment for the municipal electric light plant, to be delivered f. o. b. cars at Pasadena on or before January 10th. All bids must be segregated as to the several items bid upon.

Ookland, Cal.—In honor of the installation in the business district of the city of Oakland of a modern lighting system, the business men of the city propose to hold a celebration the early part of December. It is proposed that the night be made memorable with a street parade, participated in by the business houses, public organizations and fraternal societies of the city, and that bands be on hand to furnish music throughout the various parts of the business district. Frank F. Bilger is chairman of the committee of arrangements, and John F. Conners is acting as treasurer. It is estimated that the celebration as planned will not cost more than $3500, and a major portion of this amount has already been guaranteed.

Hemet, Cal.—C. A. Watson, a Redlands capitalist, Horace Slater and R. J. Dunn were in Hemet recently. They propose to put in a gas plant about midway between San Jacinto and Hemet, to cost $35,000? The plant is to be in operation within four months.

Quartzite, Ariz.—Herman A. Stevenson of Chicago, interested in the Cinabar group of silver claims, states that a Scott mill will be erected at once.

Venice, Cal.—Bids will be received within a short time for the installation of the electric street lighting system to be installed from Ocean Park to Santa Monica, similar to those on Los Angeles business streets.

Ventura, Cal.—The Ventura Power Company states that it will have electric light in the Ojai valley by the last of February, either by wire from the Kern river plant or from an independent plant to be erected in the valley.

TRANSPORTATION.

Pomona, Cal.—At a meeting of the City Trustees the franchise for operating an electric road in this city was sold to H. E. Huntington, who will begin work in four months.

City of Mexico, Mex.—D. E. Loweres and J. L. Purnell have taken over from Ugarte, Fernandez & Co. of Guadalajara seventy acres of land just west of the suburban town of San Andreas, near the capital. This land will be divided into tracts for farming and gardening.

Glendora, Cal.—The Pacific Electric Railway Company has let the contract for the construction of a bridge across the San Gabriel river on line of the right of way, from Monrovia to Glendora by way of Azusa. The railroad company is pushing construction work on the electric road.

Redlands, Cal.—It is now known that the franchise for an electric line to run from the center of the city to the eastern boundary line was wanted by Walter Kohl, the San Bernardino capitalist, and four Redlands men. After securing the franchise they plan to ask for rights of way to Grafton and through the Yucaipe valley to Oakglen. It is proposed to erect at Oakglen a large summer resort and pleasure park. A large hotel will be erected and an amusement pavilion. Mr. Kohl and associates will propose incorporating for $1,000,000.

San Francisco, Cal.—H. E. Farrington, formerly superintendent of the Chelsea shops of the Boston and Northern Electric Railway, has been appointed master mechanic of the United Railroads, and will take complete charge of the company's shops. He succeeds F. M. Bodier, who recently resigned to engage in private business. Farrington is regarded as one of the best men in his line in the country and brings years of experience to his work. The United Railroads is now engaged in a great deal of rehabilitation work and in repairing old cars and equipping new ones. The service requires a man thoroughly acquainted with electrical work and who knows to the minutest details how to act, and act quickly, in case of emergency. The years of service with the Boston and Northern, which is connected with the Boston Elevated Railroad, has made Farrington an invaluable man, and he undertakes his new duties thoroughly equipped for the work. He will begin at once a general inspection of the rolling stock, and says that he will take the greatest care to see that the cars now in service are always in the best of condition.

Los Angeles, Cal.—The syndicate represented by Mr. Walsh of the Wilcox building has secured the franchise for the extension of the street railway system form the intersection of Broadway and Seventh, east on Seventh street, across the new bridge, to a point beyond the city limits. The syndicate has already purchased ties and other materials for construction of the line. The City Engineer has reported that repairs are necessary on First street bridge, at estimated cost of $567, of which the Los Angeles Railway will pay $240, and the Board recommended that the Council adopt resolution for the work.

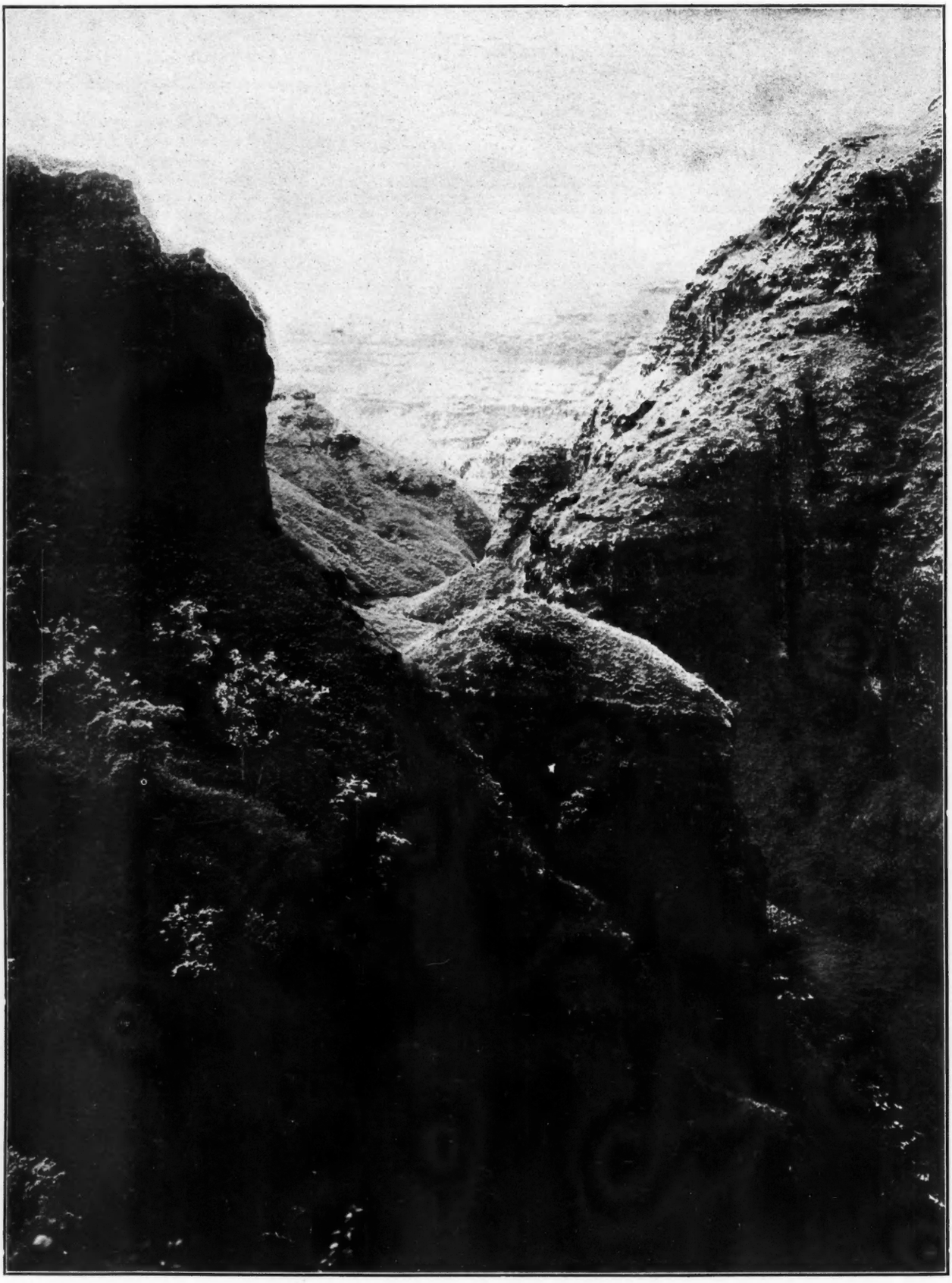
City of Mexico, Mex.—La Compania Industrial Jalisciense of Guadalajara has closed a contract through B. Targe, its electrical engineer, with Geo. Ulrich, a contractor, for the construction of an electric car line running from Epigmenio Gonzales street and will connect with the company's factories at this point.

INCORPQRATIONS.

Los Angeles, Cal.—The Porterville Gas and Electric Company has been incorporated here with the following directors: S. T. Mock, Geo. Weinberg, Moses Greenwald, Adolph Genslein and S. V. Magno.

Los Angeles, Cal.—The Sirch Electrical and Testing Laboratory has been incorporated here with a capital stock of $75,000, subscribed $500, by J. M. White, E. J. Borgmeyer, R. B. Sumner, H. F. Anderson and A. B. Thomson.

San Francisco, Cal.—The Buell Rancho Oil Company has been incorporated with a capital stock of $100,000, subscribed $500, by W. S. Porter, B. E. Green, M. H. Whittier, F. A. Garbutt and W. E. Dun. Place of business, San Francisco.



CANON OF MAKAWELI RIVER, KAUAI, T. H.

Irrigation Works in the Hawaiian Islands